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Staging, Storage, Sizing, and Treatment Facility (SSSTF)

Preliminary Hazard Classification Analysis

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

INEEL
Idaho National Engineering & Environmental Laboratory
BECHTEL BWXT IDAHO, LLC

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3. Subtask: SSSTF Performance Categorization for Natural Phenomena Hazards Design

4. Title: Staging, Storage, Sizing, and Treatment Facility (SSSTF) Preliminary Hazard Classification Analysis

5. Summary: This Engineering Design File (EDF) documents the determination of the Performance Category (PC) of the various structures, systems, and components (SSCs) of the Staging, Storage, Sizing, and Treatment Facility (SSSTF). The PC is needed to apply appropriate design criteria as it relates to natural phenomena hazards to each SSC. The PC assignment is based on information determined during safety analysis activities of which the preparation of the Preliminary Hazard Categorization/Classification Report is a first step. This report (prepared as EDF-ER-226) is attached as Appendix B to this EDF.

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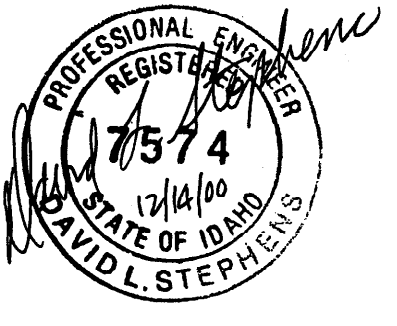

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ACRONYMS

AEP	Annual Exceedance Probability
ASCE	American Society of Civil Engineers
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
EDF	Engineering Design File
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
NPH	Natural Phenomena Hazard
PC	Performance Category
SSC	System, Structure, or Component
SSSTF	Staging, Storage, Sizing, and Treatment Facility
UBC	Uniform Building Code
USGS	United States Geological Survey
WAG	Waste Area Group

Staging, Storage, Sizing, and Treatment Facility (SSSTF) Performance Categorization for Natural Phenomena Hazards Design

1. INTRODUCTION

The U.S. Department of Energy Idaho Operations Office (DOE-ID) authorized a remedial design/remedial action (RD/RA) for the Idaho Nuclear Technology and Engineering Center (INTEC) in accordance with the Waste Area Group (WAG) 3, Operable Unit (OU) 3-13 Record of Decision (ROD).[1]

The ROD requires Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) remediation wastes generated within the Idaho National Engineering and Environmental Laboratory (INEEL) boundaries to be removed and disposed of onsite in the INEEL CERCLA Disposal Facility (ICDF). The ICDF, which will be located south of INTEC and adjacent to the existing percolation ponds, will be an onsite, engineered facility, meeting Resource Conservation and Recovery Act (RCRA) Subtitle C, Idaho Hazardous Waste Management Act (HWMA), and polychlorinated biphenyl (PCB) landfill design and construction requirements. The ICDF will include the necessary subsystems and support facilities to provide a complete waste disposal system.

The major components of the ICDF are the disposal cells, an evaporation pond, and the Staging, Storage, Sizing, and Treatment Facility (SSSTF). The disposal cells, including a buffer zone, will cover approximately 40 acres, with a disposal capacity of about 510,000 cy. Current projections of INEEL-wide CERCLA waste volumes total about 483,800 cy. The SSSTF will be designed to provide centralized receiving, inspection, and treatment necessary to stage, store, and treat incoming waste from various INEEL CERCLA remediation sites prior to disposal in the ICDF, or shipment offsite. All SSSTF activities shall take place within the WAG 3 area of contamination (AOC) to allow flexibility in managing the consolidation and remediation of wastes without triggering Land Disposal Restrictions (LDRs) and other RCRA requirements, in accordance with the OU 3-13 ROD. Only low-level, mixed low-level, hazardous, and limited quantities of Toxic Substances Control Act (TSCA) wastes will be treated and/or disposed of at the ICDF. Most of the waste will be contaminated soil, but debris and Investigative Derived Waste (IDW) will also be included in the waste inventory. ICDF leachate, decontamination water and water from CERCLA well purging, sampling, and well development activities will also be disposed of in the ICDF evaporation pond.

Only INEEL onsite CERCLA wastes meeting the agency approved Waste Acceptance Criteria (WAC) will be accepted at the ICDF. An important objective of the WAC will be to ensure that hazardous substances disposed in the ICDF will not result in exceeding groundwater quality standards in the underlying groundwater aquifer. Acceptance criteria will include restrictions on contaminant concentrations based on groundwater modeling results with the goal of preventing potential future risk to the Snake River Plain Aquifer (SRPA).

This document describes all the Performance Categories (PC) for Natural Phenomena Hazard design as defined by DOE-STD-1021 and assigns a preliminary PC for each system in the SSSTF.

2. PERFORMANCE CATEGORIZATION OF THE SSSTF

Section 2 consists of a discussion of how the performance categories of structures, systems, and components (SSCs) of the SSSTF are determined. The design criteria associated with natural phenomena (seismic, wind, and flood) for the SSCs are included.

2.1 Assignment of Performance Categories

The performance categorization of the SSSTF is made in accordance with the procedure outlined in DOE-STD-1021-93, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components.*[1] The SSSTF will be considered to consist of systems and these systems to consist of components. Since the various buildings and structures that make up the SSSTF will perform major and distinct functions, either by themselves or together with other components, they will be referred to herein as systems.

Typically, the systems of a facility are divided into "safety systems" and "other systems." These systems can then be further divided into groups. Group I consists of safety systems that must function during and after a Natural Phenomena Hazard (NPH) event. Typically these systems involve the control of radiological or toxic hazards. Group II consists of safety systems that are not in Group I. Finally, Group III consists of other systems that do not perform any safety function by themselves.

At this point it is possible to set up a system-function matrix for each class of system where each system important to a particular function, such as containment/confinement, is identified. Once this matrix is set up, a preliminary performance category can be assigned either on a (1) system-by-system basis, (2) segment-by-segment basis, or (3) component-by-component basis.

Of the three methods, the system-by-system method is the most conservative. Yet, it is the preferred method when selecting an initial performance category or when insufficient data are available from system safety and accident analyses. In this method all the components of a system are assumed to have the same performance category, which is the highest category assigned to any given component of the system. Thus, the system as a whole is assigned the same performance category.

2.2 Basic Categorization Guidelines

The performance categories below are for preliminary categorization of SSCs. The preliminary performance category may not account for system interactions, if any. The basic categorization guidelines are summarized in the flow chart shown in Figure 1-1 and described in the following paragraphs category by category.

2.2.1 Performance Category 4

"An SSC shall be placed in preliminary Performance Category 4 (PC-4) if it is a "safety-class" item as defined in STD-3009-94 and if its failure during an NPH event could result in off-site release consequences greater than or equal to the unmitigated release from a large (>200 MWt) Category A reactor severe accident. There are not expected to be many such facilities in the DOE complex. Not all safety-class SSCs are necessarily PC-4. If the adverse off-site consequences from an NPH event are significant enough to make them safety-class but are substantially less than those associated with an unmitigated large Category A reactor severe accident, the SSCs should be placed in PC-3. An SSC that does not satisfy the above criteria may also be placed in PC-4 for improved performance if justified from cost-benefit considerations."[1]

2.2.2 Performance Category 3

"An SSC shall be placed in preliminary Performance Category 3 (PC-3) if it is not covered in Paragraph 1.2.1 above, and if: its failure results in adverse release consequences greater than safety-class

SSC Evaluation Guidelines limits but much less than those associated with PC-4 SSCs. An SSC that does not satisfy the above criteria may also be placed in PC-3 for improved performance if justified from cost-benefit considerations. For new facilities, since it may not cost too much more to design the facility as PC-4 instead of PC-3, it may be desirable to design such PC-3 facilities in the conceptual design stage to PC-4 criteria, subject to funding constraints."[1]

2.2.3 Performance Category 2

"An SSC shall be placed in preliminary Performance Category 2 (PC-2) if it is not covered in Paragraphs 1.2.1 or 1.2.2 above, and if any of the following conditions apply:

(i) The SSC's failure by itself or in combination with one or more SSCs may result in loss of function of any emergency handling, hazard recovery, fire suppression, emergency preparedness, communication, or power system that may be needed to preserve the health and safety of workers and visitors. This includes NPH-caused release of radioactive and toxic materials that would result in these consequences.

(ii) The SSC is part of a building which is primarily used for assembly of more than 300 persons (in one room), and the SSC failure may adversely affect the life safety of the occupants.

(iii) The SSC has been classified "safety-significant."

An SSC that does not satisfy the above criteria may also be placed in PC-2 from cost and mission considerations, e.g., when SSC failure causes excessive downtime, the SSC is very difficult to replace, or SSC replacement/repair is very costly."[1]

2.2.4 Performance Category 1

"An SSC that is not covered in Paragraphs 1.2.1, or 1.2.2, and 1.2.3 above shall be placed in preliminary Performance Category 1 (PC-1) if any of the following conditions apply:

(i) It is a building/structure with potential human occupancy.

(ii) The SSC's failure may cause a fatality or serious injuries to in-facility workers.

(iii) The SSC's failure may cause damage that can be prevented or reduced cost-effectively by designing it to withstand NPH effects."[1]

2.2.5 Performance Category 0

"An SSC that is not covered in Paragraphs 1.2.1 through 1.2.4 above may be placed in preliminary Performance Category 0 (PC-0) if it is not important because of safety, mission, or cost considerations, and if it is more cost-effective to replace or repair it than to design it to withstand NPH effects; however, an SSC whose failure may have any adverse effect on the performance of a PC-1, PC-2, PC-3, or PC-4 SSC shall not be placed in PC-0."[1]

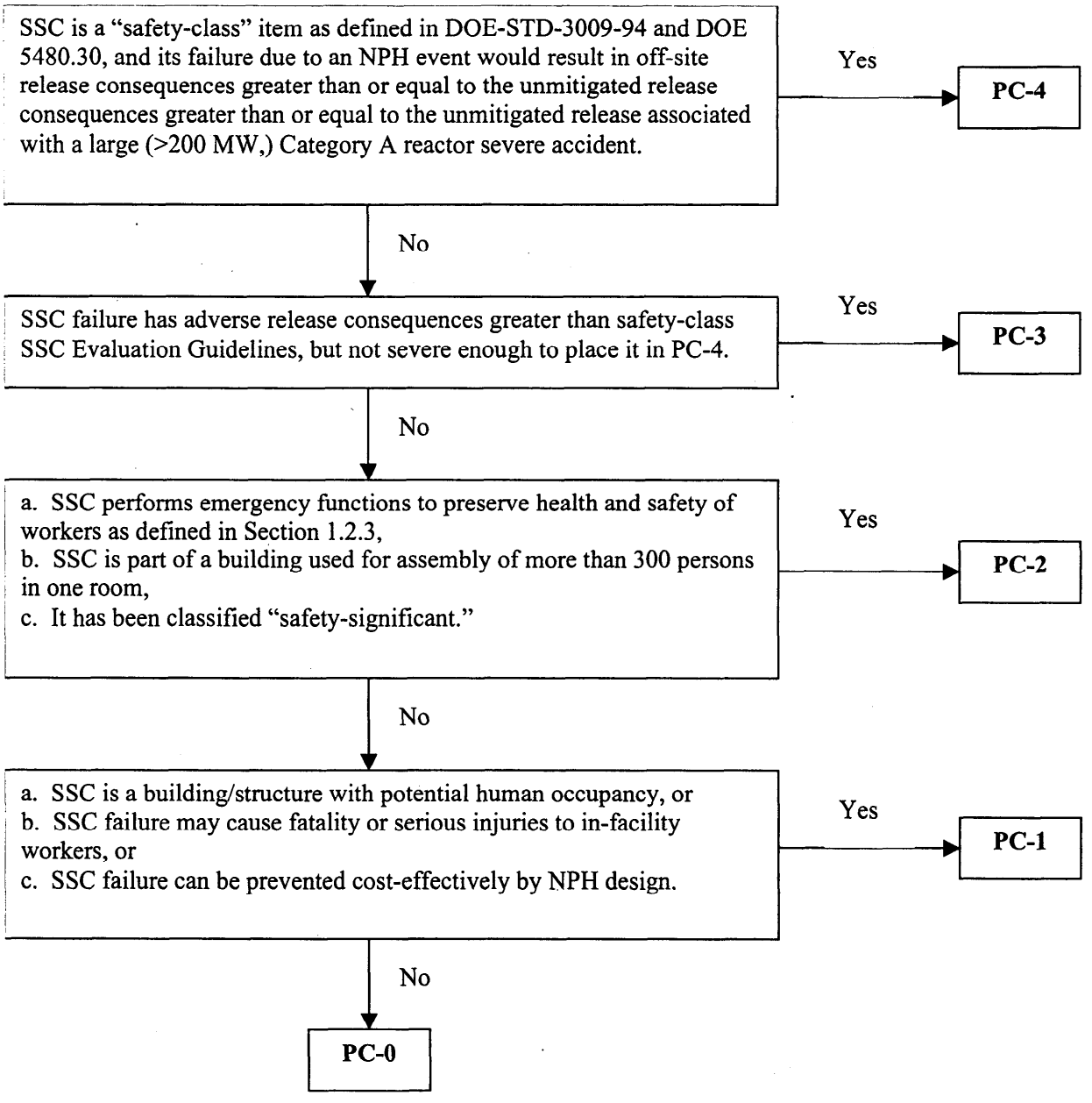

Figure 1-1. Basic Guidelines for Preliminary NPH Performance Categorization of Structures, Systems, and Components.

Currently, the Preliminary Hazard Categorization Report for the INEEL Operable Unit 3-13 Waste Disposal Complex (included as Appendix B) states that the preliminary category is "Category 3, Nuclear." However, this same report also states that as a result of the forthcoming facility accident analysis, the entire complex (including the SSSTF) will be operated as a "Radiological, Low Hazard Facility." Additionally, based on preliminary information from the safety classification of SSCs, determined in accordance with DOE 5480.30,[2] DOE 5481.1B,[3] and DOE-STD-3009-94,[4] the SSSTF will have no safety class, nor safety significant systems. Further, no structures, systems, or components that perform an emergency function to preserve health and safety during and after a NPH event, are expected to be identified in the forthcoming Auditable Safety Analysis.

Based on the preceding information and following Figure 1-1 above, the following preliminary performance categories are assigned.

1. Treatment building—PC-1
2. Administration building—PC-1
3. Decontamination building—PC-1
4. Storage pads—PC-1.

Since there are no safety class nor safety significant systems the SSSTF systems cannot be categorized as PC-4 or PC-3. Further, since no system is expected to be identified that performs an emergency function to mitigate the results of an NPH event, the SSSTF systems cannot be categorized as PC-2. Finally, since all of the SSSTF systems will have human occupancy, may cause fatality to in-facility workers, or their failure can be prevented cost-effectively, they are categorized as PC-1.

As more information from the safety analysis activities becomes available, it may be necessary to upgrade some of these PC-1 systems to PC-2 systems. Additionally, it may be desirable to upgrade some PC-1 systems to PC-2 systems based on replacement costs and/or mission criticality considerations. The cost delta between designing for a PC-1 system vs. a PC-2 system is minor considering there is no additional analyses required and only minor increases in material cost.

2.3 Facility Design Criteria

The design criteria for Performance Category 1 are referenced below for each natural phenomenon covered in DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities.*[5]

2.3.1 Seismic

Conform to the requirements of DOE-STD-1020, which directs the use of the Uniform Building Code (UBC) methodology with no modifications.

2.3.2 Wind

Conform to the requirements of DOE-STD-1020, which directs the use of American Society of Civil Engineers (ASCE) 7, *Minimum Design Loads for Buildings and Other Structures.* 90 mph gust speed shall be used.

2.3.3 Flood

Flood design shall be in accordance with DOE-STD-1020. The Design Basis Flood Level is equal to the flood whose mean annual exceedance probability (AEP) is 2×10^{-3}.

Although the flood criteria defined in the Final Record of Decision for Operable Unit 3-13[6] will be met for the SSSTF (construction to take place outside the United States Geological Survey [USGS] defined 100-yr flood plain), the site must also meet the above U.S. Department of Energy (DOE) requirement for flood design. This requirement will be met by siting a DOE-initiated flood screening analysis report[7] published in September 1999 by the Bureau of Reclamation.

The USGS report published in 1998[8] gives a 100-yr peak flow of 7,260 cubic feet per second (cfs) for the Big Lost River at the Idaho National Engineering and Environmental Laboratory (INEEL). This flow corresponds to a water-surface elevation of 4,918 ft near the southwest corner of Idaho Nuclear Technology and Engineering Center (INTEC). This elevation contour extends past the area occupied by Substation No. 2 from the north (See Appendix A), but does not extend into any of the areas proposed for the SSSTF site.

The corresponding peak flow for a design basis flood with an AEP of 2×10^{-3} is 4,086 cfs, as reported in the Bureau of Reclamation's report[7]. Since this flow is much less than the 7,260 cfs determined for the USGS 100-yr flood, the risk of flooding in the area of the SSSTF due to a PC-1 design basis flood is considered negligible.

3. REFERENCES

1. U.S. Department of Energy, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*, Change Notice #1, DOE-STD-1021-93, January 1996.

2. U.S. Department of Energy, "Nuclear Reactor Safety Design Criteria," DOE Order 5480.30, January 1993.

3. U.S. Department of Energy, "Safety Analysis and Review System," DOE Order 5481.1B, September 1986.

4. U.S. Department of Energy, "Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports," DOE-STD-3009-94, July 1994.

5. U.S. Department of Energy, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*, Change Notice #1, DOE-STD-1020-94, January 1996.

6. U.S. Department of Energy Idaho Operations Office, *Final Record of Decision, Idaho Nuclear Technology and Engineering Center*, Operable Unit 3-13, Idaho National Engineering and Environmental Laboratory, DOE/ID-10660, Rev. 0, October 1999.

7. Ostenna, Dean A. et al., *Phase 2 Paleohydrologic and Geomorphic Studies for the Assessment of Flood Risk for the Idaho National Engineering and Environmental Laboratory, Idaho*, Report 99-7, Geophysics, Paleohydrology, and Seismotectonics Group, Technical Services Center, Bureau of Reclamation, Denver, CO, September 1999.

8. Berenbrock, Charles and Kjelstrom, L. C., *Preliminary Water-Surface Elevations and Boundary of the 100-year Peak Flow in the Big Lost River at the Idaho National Engineering and Environmental Laboratory, Idaho*, Report 98-4065, U.S. Geological Survey Water-Resources Investigations, 1998.

Appendix A

SSSTF Siting Study Proposed Sites Drawing Showing 100-yr Flood Zone

FMT-01-REV 3.3

REVISIONS		
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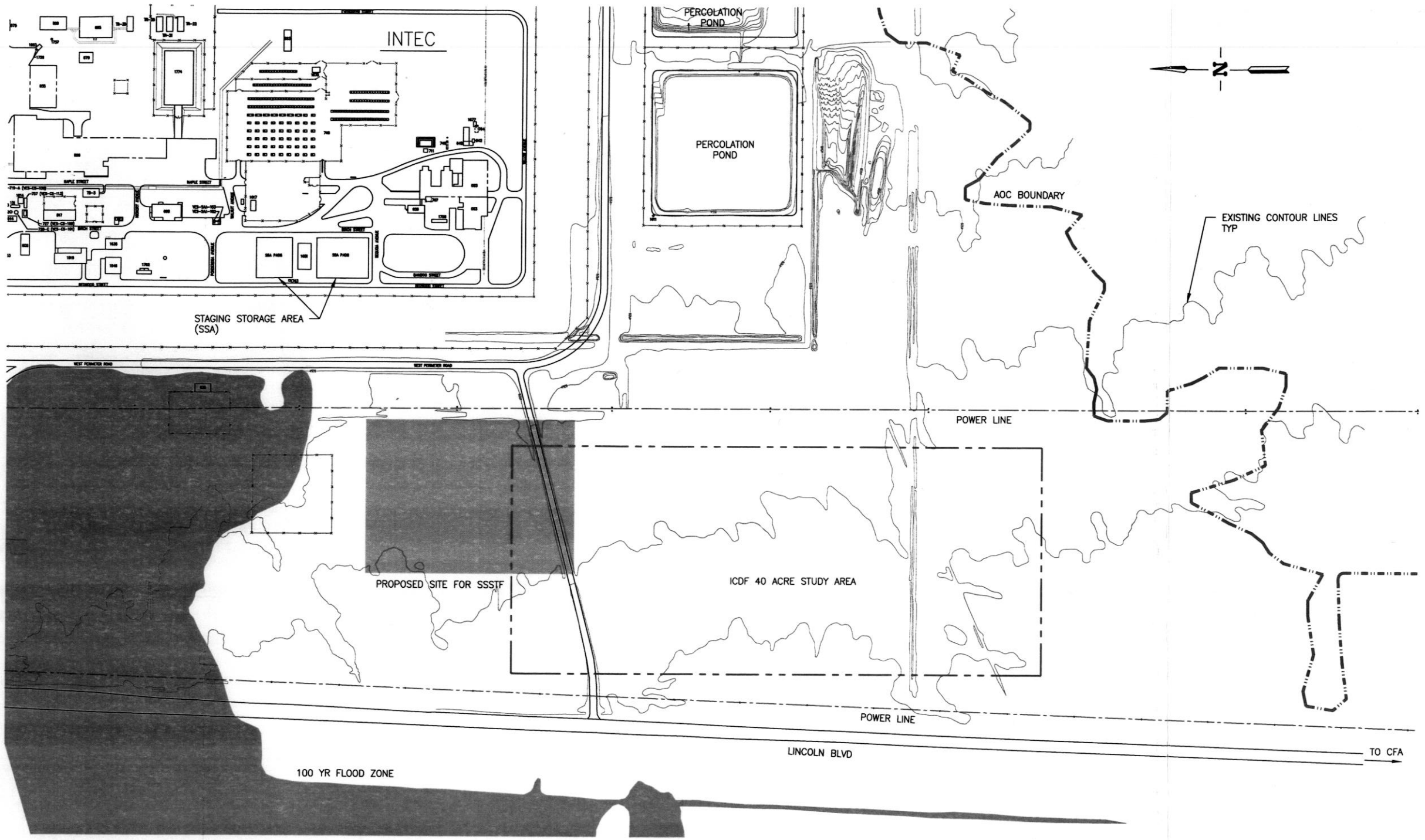

SITE PLAN

DATUM BASED ON NAD27 STATE PLANE
HORIZONTAL FOR NORTHING AND EASTING

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	DESIGN: D. L. STEPHENS	WAG-3 SSSTF PROPOSED SITE
	DRAWN: Gene K Mace	
	PROJECT NO.	
	SPEC CODE	
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